
Chapter 5 — DTI Implementation

Overview

This chapter provides the information required to install DTI on a Meridian 1 Option 11 system:

- hardware and software installation
- programming procedures for basic call service.

This chapter covers the most common type of Northern Telecom DTI installation, a 24-channel Digital Trunk Interface (DTI) installation between two Meridian 1 systems, or a Meridian 1 and a central office.

Hardware Requirements

To implement DTI on the Meridian 1 Option 11, the following hardware is required:

Table 28
DTI hardware

Item	Description
NTAK09	DTI/PRI Circuit card
NTAK20	Clock Controller Daughter board. Note: The Option 11 supports only one active Clock Controller per system
NTBK04	Carrier Cable

Cables

The following cables are required for DTI connections:

- DTI to external T1 cable
- NTBK04 - carrier cable
- NT8D97 50 foot extension (if needed)

Channel Service Units

When connecting the DTI/PRI to the public network, Channel Service Units (CSUs) are required by most operating companies. One CSU is required per DTI. Suitable CSUs which support 64 Kbps clear and Bipolar 8 Zero Substitution (B8ZS) are available from vendors such as Verilink, Digitalink, Kentrox and Tellabs.

Note: Contact your Northern Telecom Sales representative for specific local CSU requirements.

Echo Cancellor

Echo Cancellers are required for voice calls over direct satellite links using DTI.

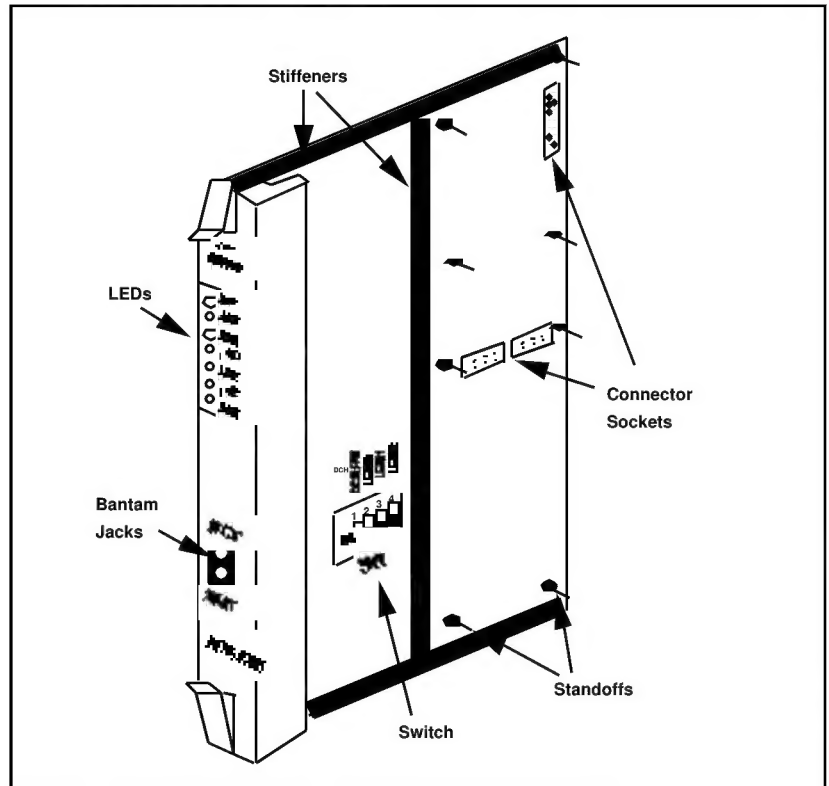
Note: Echo Cancellor control is currently not supported on Option 11.

NTAK09 DTI/PRI circuit card

The Digital Trunk Interface/Primary Rate Interface (DTI/PRI) card provides the physical interface for the DS-1 facility T-1 carrier on the Meridian 1 Option 11. It is required for PRI and DTI operation and is also used for ISL shared-mode applications.

The DTI/PRI is made up of a single circuit card which occupies any single card slot (1 through 9) in the Option 11 main cabinet. Figure 64 shows the faceplate layout, the location of the switch and the position of the daughterboards and connectors. See the “DTI/PRI maintenance” chapter in this guide for information about the faceplate LEDs.

Figure 64
NTAK09 DTI/PRI circuit card



NTAK20 Clock Controller (CC) daughterboard

Digital Trunking requires synchronized clocking so that a shift in one clock source will result in an equivalent shift of the same size and direction in all parts of the network. On Option 11 systems, synchronization is accomplished with the NTA20 clock controller daughterboard.

The Clock Controller circuitry synchronizes the Option 11 to an external reference clock and generates and distributes the clock to the system. This enables the Option 11 to function either as a slave to an external clock or as a clocking master. The NTAK20AA version of the clock controller meets AT&T Stratum 3 and Bell Canada Node Category D specifications. The NTAK20BA version meets CCITT stratum 4 specifications. See the chapter titled *Network clocking* for details.

Clocking modes

The Option 11 system supports a single clock controller that can operate in one of two modes: tracking or non-tracking (also known as free-run).

Tracking mode

In tracking mode, one or possibly two DTI/PRI cards supply a clock reference to a clock controller daughterboard. When operating in tracking mode, one DTI/PRI is defined as the primary reference source for clock synchronization, while the other is defined as the secondary reference source (PREF and SREF in LD 73).

There are two stages to clock controller tracking:

- tracking a reference, and
- locked onto a reference.

When tracking a reference, the clock controller uses an algorithm to match its frequency to the frequency of the incoming clock. When the frequencies are very near to being matched, the clock controller is locked onto the reference. The clock controller will make small adjustments to its own frequency until both the incoming and system frequencies correspond.

If the incoming clock reference is stable, the internal clock controller will track it, lock onto it, and match frequencies exactly. Occasionally, however, environmental circumstances will cause the external or internal clocks to drift. When this happens, the internal clock controller will briefly enter the tracking stage. The green LED will flash momentarily until the clock controller is locked onto the reference once again.

If the incoming reference is unstable, the internal clock controller will continuously be in the tracking stage, with the LED flashing green all the time. This condition does not present a problem, rather, it shows that the clock controller is continually attempting to lock onto the signal. If slips are occurring, however, it means that there is a problem with the clock controller or the incoming line.

Free-run (non-tracking)

In free-run mode, the clock controller does not synchronize on any source, it provides its own internal clock to the system. This mode can be used when the Meridian 1 is used as a master clock source for other systems in the network. Free-run mode is undesirable if the Meridian 1 is intended to be a slave. It can occur, however, when both the primary and secondary clock sources are lost due to hardware faults or when invoked by using software commands.

LED states

The CC LED on the NTAK09 faceplate will be in various states, depending on the status of the Clock Controller:

CC LED	CC status
On (Red)	NTAK20 is equipped and disabled.
On (Green)	NTAK20 is equipped and is either locked to a reference or is in free run mode.
Flashing (Green)	NTAK20 is equipped and is attempting to lock (tracking mode) to a reference. If the LED flashes continuously over an extended period of time, check the CC STAT in LD60. If the CC is tracking this may be an acceptable state. Check for slips and related clock controller error conditions. If none exist, then this state is acceptable, and the flashing is identifying jitter on the reference.
Off	NTAK20 is not equipped.

Installing DTI hardware

The DTI hardware installation procedure is independent of the type of system at the far end (another Meridian 1, DMS-100, or DMS-250).

Use the following procedure to mount and remove the NTAK20 daughterboard onto the NTAK09 DTI/PRI card.

Mounting the NTAK20 daughterboard on the NTAK09

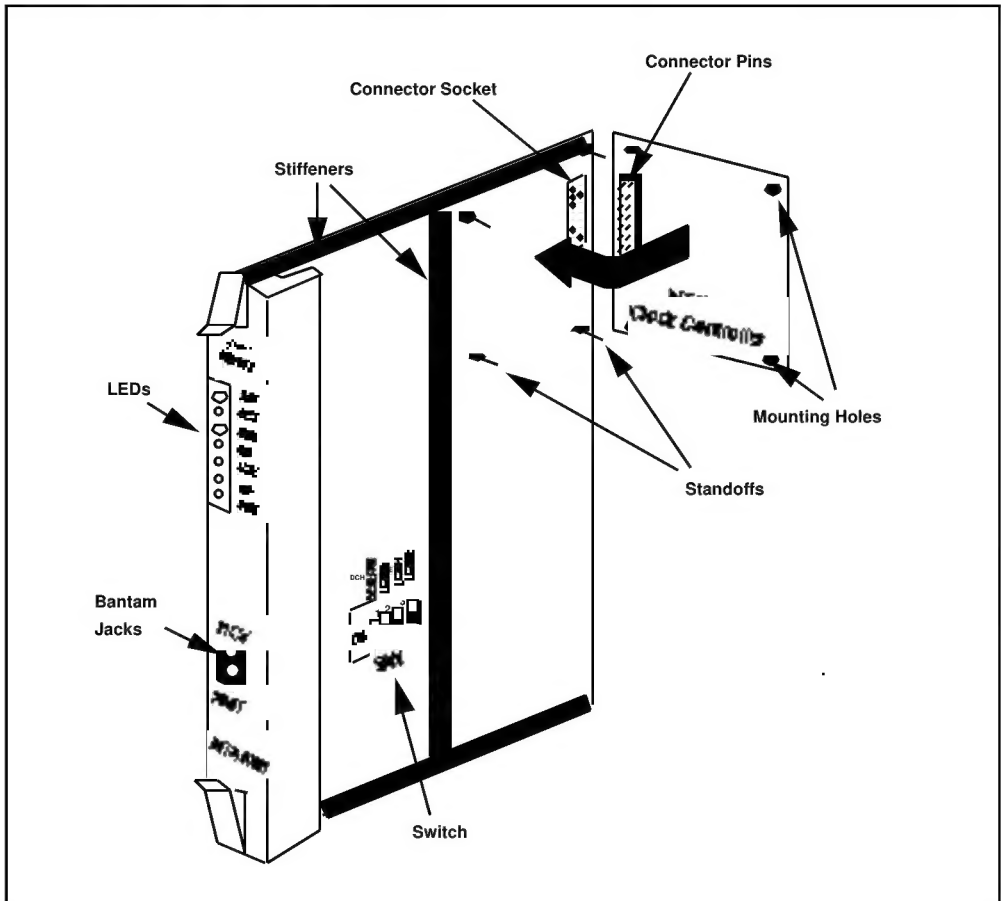
Work on a flat surface when mounting or removing daughterboards.

- 1 Visually inspect the connector pins on the underside of the NTAK20. Any pins that are bent should be re-aligned prior to mounting.
- 2 Place the NTAK09 down flat on the anti-static pad.
- 3 From an overhead viewpoint, with the NTAK20 parallel above the NTAK09 and the connector pins aligned over the connector sockets, line up the mounting holes of the NTAK20 (see Figure 65) with the tops of the standoffs that are installed on the NTAK09.
- 4 Slowly lower the NTAK20 towards the NTAK09, keeping the standoffs in line with all four holes, until the holes are resting on the tops of the four standoffs.

If more than a very slight amount of pressure is required at this point, the connector pins may not be aligned with the connector socket. If so, lift the daughterboard off the NTAK09 and return to step 2.

- 5 Gently apply pressure along the edge of the board where the connector is located until the STAND OFFS at the two corners adjacent to the connector snap into a locked position. Then press down on the two corners on the opposite side until they also are locked into place.

Figure 65
Daughterboard installation



Removing the NTAk20 daughterboard from the NTAk09

- 1 Starting at the two corners opposite the connector, gently lift each corner out of the locking groove of the standoff.
- 2 At the two corners adjacent to the connector, gently lift the entire side by hand until the mounting holes are clear of the locking groove of the standoff.
- 3 To remove the connector pins, grasp the edge of the board adjacent to the connector by hand and lift gently.

Note: If you are installing more than one NTAk09 card, the additional cards may not carry daughterboards. At least one NTAk20, however, will always be required.

Setting the switches

Set the switches on the NTAk09 DTI/PRI card according to the following table.

Table 29
NTAk09 switch settings

Switch Setting	1 DCH F/W	2 (LEN 0)	3 (LEN 1)	4 (LEN 2)
Distance to Digital Cross-Connect				
0 - 133 feet	Off	Off	Off	On
133 - 266 feet	Off	On	On	Off
266 - 399 feet	Off	Off	On	Off
399 - 533 feet	Off	On	Off	Off
533 - 655 feet	Off	Off	Off	Off

Inserting the NTAk09 into the main cabinet

Insert the NTAk09 circuit card into the desired slot in the Option 11 main cabinet. (Card slots 1 through 9 are available.)

Check for available card slots in the base cabinet and print the configuration record to determine which slots may be used. To do this, use PRT CFN in LD 22.

Connecting the cables

Connect the NTBK04 cable to the 50-pin amphenol below the card slot in which the NTAK09 circuit card is installed. Connect the other end of the cable to the CSU or DSX-1 cross connect.

The NTBK04 is twenty feet long. If additional distance is required, the NT8D97AX fifty-foot extension is available up to a 600 foot maximum. The only cable required to support the NTAK09 circuit card is the NTBK04.

If you require pinout information on the NTBK04 cable, refer to the table below.

Table 30
DS-1 line interface pinout for NTBK04 cable

From 50-pin MDF connector	to DB-15	signal name	description
pin 48	pin 1	T	transmit tip to network
pin 23	pin 9	R	transmit ring to network
pin 25	pin 2	FGND	frame ground
pin 49	pin 3	T1	receive tip from network
pin 24	pin 11	R1	receive ring from network

Software enabling the card

Use step 1 to enable the NTAK09 DTI/PRI card. Go to step 2 only if the clock controller is not enabled in step 1.

Step 1:

Software enable all NTAK09 DTI/PRI cards using the overlay 60 command

ENLL C

where C is the DTI/PRI card number (DLOP). The card number associated with a DTI/PRI card is based on the slot in which the card is installed.

Step 2: (if required):

Software enable the clock controller using overlay 60.

Enable clock tracking on primary digital loop by issuing the following command:

ENL CC 0

Programming DTI

Use this procedure to program the DTI software interface between Meridian 1 systems or between a Meridian 1 system and a central office.

Compatibility

The NTAK09 card supports DTI with Extended Superframe Format (ESF). ESF provides a Cyclic Redundancy Check (CRC) which is a block error code comparison for deriving performance measurement. Option 75 (PBXI) must be enabled to provide DTI with ESF. Option 75 (PBXI), option 145 (ISDN) and option 146 (PRA) must be enabled to provide CRC.

Restrictions and Limitations

The allowable range of main-cabinet slot numbers for the DTI/PRI circuit card is 1-9. Note that the CPU/Conf circuit card is provisioned in slot 0, and the TDS card is provisioned in slot 1, effectively leaving slots 2-9 available to these interface cards.

Service change and maintenance commands that refer to loop numbers refer to slot numbers in the Option 11 system.

Programming procedure

- 1 Define error detection thresholds — LD73.
- 2 Add a DTI loop — LD17.
- 3 Define the route data block for the DTI — LD16.
- 4 Define the trunks associated with step 3 — LD14.
- 5 Define clock synchronization — LD73.

Step 1:

Define the threshold parameters. Use Overlay 73.

Prompt	Response	Description
REQ	NEW	
TYPE	DDB	digital data block
TRSH	0-15	assign a threshold set or table, enter this number in overlay 17 when defining a PRI digital loop
RALM	1-(3)-128	yellow alarm 24-hour threshold
BIPC	1-(2)-128	24-hour bit rate violation threshold
LFAC	1-(3)-128	24-hour loss of frame alignment threshold
BIPV	1-(2 or 3)-4	bit rate (bipolar violation and CRC) monitoring limits for maintenance and out-of-service thresholds
SRTK	1-(5)-24	frame slip-tracking-monitoring limits (in hours)
SRNT	1-(15)-1024 1-(3)-1024	non-tracking slip-rate monitoring maintenance and out-of-service thresholds
SRIM	(1)-127	slip rate improvement timer
SRMM	(2)-127	maximum number of times the slip rate exceeds the maintenance limit
LFAL	1-(17)-10240 1-(511)-10240	loss of frame alignment monitoring limits

Step 2:

Add a DTI loop. Use Overlay 17.

Prompt	Response	Description
REQ	CHG	
TYPE	CFN	configuration data block
...		
PARM	YES	
...		
PCML	(MU) A	System PCM law. Default is MU law
...		
CEQU	YES	changes to common equipment
DLOP	C dd ff	where : • C is the DTI/PRI digital card number (1-9) • dd is the number of data calls allowed (0-24) on this DTI (default 24) • ff is the frame format used (D2,D3,D4,ESF) where default is ESF
MODE	TRK	select Digital Trunk Interface mode
YALM	DG2 (FDL)	yellow alarm method — prompted only if the frame format is ESF — Must match the far end. Use FDL with ESF and use DG2 with non-ESF. If not prompted then DG2 is set automatically.
TRSH	0-15	the maintenance and threshold table to be used for this DTI loop, as configured in overlay 73.

Step 3:

Configure a DTI trunk route. Use Overlay 16.

Prompt	Response	Description
REQ	NEW,CHG	
TYPE	RDB	route data block
TKTP		create a trunk route
	COT	Central Office Trunk data block
	WAT	WATS Trunk data block
	DID	Direct Inward Dial Trunk data block
	TIE	TIE Trunk data block
	FEX	Foreign Exchange= Trunk data block
DTRK	YES	digital trunk route

Step 4:

Configure the trunks. Use Overlay 14.

Prompt	Response	Description
REQ	NEW,CHG	
TYPE	XXX	One of the trunk types defined in step 3
TN	C ch	enter the DTI/PRI trunk card (C) and channel number (ch). C = 1-9, ch = 1-24
RTMB	RRR MMM	route (created in step 3) (RRR) and member number (MMM).

Step 5:

Assign clock's reference source. Use Overlay 73.

Prompt	Response	Description
REQ	CHG	
TYPE	DDB	Digital Data Block
CLKN	1-9	Card slot number of the NTAK09 circuit card which supports the NTAK20 Clock Controller.
PREF	1-9	This is the DTI/PRI T1 which the clock controller will use as its primary source to synchronize (track) the system network clock. A carriage return <CR> here signifies the system will operate in free-run (non-tracking). Note that free-run is used when this Meridian PBX serves as the clock source master for the private network. See the chapter called <i>Network Clocking</i> for more details on clocking.
SREF	1-9	Secondary reference source for clock controller — prompted only if primary source is not free-run. Enter the DTI card number of the DTI/PRI card which is to be used as the secondary clock reference. This is the PRI T1 which the clock controller will use as its secondary source to synchronize (track) the system network clock. Only used when unable to track on the primary source (i.e. too many slips)